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Planning for future X-ray astronomy missions

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Abstract. Space science has become an international business. Cutting-edge missions are too expensive and too complex for any one country to have the means and expertise to construct. The next big X-ray mission, Astro-H, led by Japan, has significant participation by Europe and the U.S. The two premier missions currently operating, Chandra and XMM-Newton, led by NASA and ESA, respectively, are thoroughly international. The science teams are international and the user community is International. It makes sense that planning for future X-ray astronomy missions — and the eventual missions themselves — be fully integrated on an international level.

1. Introduction

The international X-ray community is now engaged in planning the next major X-ray observatory. There are two competing visions for what its primary capabilities should be. The unprecedented spatial resolution of the Chandra X-ray Observatory has allowed ever fainter sources to be characterized – the active galactic nuclei that comprise the X-ray background, neutron stars, stars, and much more. Enhanced spectral resolution on Chandra and XMM-Newton has improved our understanding of supernova remnants, clusters of galaxies, accretion onto compact objects, and much more. Because X-ray astronomy is usually in a photon-limited regime, high throughput – significantly beyond the large area of XMM-Newton – is needed to take full advantage of superb spatial and spectral resolution.

It is not surprising that there are strong arguments for all these capabilities. Following the usual practice, multi-purpose missions are under consideration – observatories that simultaneously deliver excellent spatial and spectral resolution, and the high throughput that such capabilities demand.

But combining everyone's wish list into a single mission appears to be quite expensive, not to mention that it inevitably leads to compromise in one capability or another. Moreover, each space agency has its own planning and budget process, and inter-agency coordination has many challenges. Could there be another approach? One that allows scientists around the world to carry out the best possible science, whether it requires high spatial resolution, spectral resolution and/or throughput? Might there be options beyond complete compromise or unfettered competition?

Here is one possible scenario: the principal agencies (which at this moment are NASA and ESA, given Japan's current leadership of Astro-H) could build two separate satellites, one optimized for the best possible spatial resolution and one for high throughput spectroscopy. Each would have a completely international science team and all data would be shared freely among participating nations – or perhaps with a truly open-skies, sciencedriven program. Time scales and budgets could be determined separately, by the lead agencies, unhampered by restrictions dictated by technology-transfer (ITAR) laws or planning processes that are not synchronized. Given the cost of complexity, decoupling the missions should not be appreciably more expensive. Cooperation without the compromise, complexity or cost: this could be a chance to get most or all of what the science demands.

There are surely other scenarios that should be considered. At the close of the meeting in Milan, a lively discussion among the conference participants explored many options. Scores of excellent ideas were aired. But this was just the beginning. More international talks were held in February 2013 in Japan. Similar talks will continue, among scientists as well as space agencies. After all, we are after answers to the kinds of compelling science questions outlined in the decadal surveys, roadmaps and white papers generated by every scientific community and space agency. There is no lack of scholarly ambition or technical ingenuity in our community. What is needed now is agility and innovation in our thinking and planning.